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N89-28150 125.0 NLY

ICE SHEET RADAR ALTIMETRY

by

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The surface topography of the Greenland and Antarctic ice sheets between 72 degrees north and south is mapped using radar altimetry data from the U. S. Navy GEOSAT. The glaciological objective of this activity are to study the dynamics of the ice flow, changes in the position of floating ice-shelf fronts, and ultimately to measure temporal changes in ice surface elevation indicative of ice sheet mass balance.

The ongoing activities include extensive processing of the GEOSAT radar altimeter data to obtain corrected ice surface elevations and to produce validated data sets for glaciological research. Data processing techniques have been developed to account for the differences in the operation of radar altimeters over sea ice and the continental ice sheets, as compared to ocean surfaces for which they were designed. In particular, computer retracking is required to correct for the range error caused by lags in the altimeter's automatic tracking circuit that adjusts for changes in the expected range between radar pulses. Each 10/second waveform, representing the received radar signal, is fitted with a five- or nine- parameter function to determine its shape and the position of the mid-point of the ramp with respect to the central range gate, which gives a range correction of typically several meters. Atmospheric and tidal corrections are also applied.

Preliminary elevation maps have been made of Greenland and parts of Antarctica. Crossover analysis shows an overall precision of about 1.6 M with a mean ascending-descending orbit bias of -0.5 M. Procedures have also been developed for editing and smoothing SEASAT data over sea ice, to produce ocean surface maps over the sea ice regions surrounding the ice sheets. These ocean surfaces will be used to reduce the error in the radial component of the satellite orbit and tie the data to a common reference level. Glaciological studies with the data include definition of ice flow directions, the positions of ice divides and drainage basins, the locations of ice rises in Antarctic ice shelves, and other features of ice shelves and ice sheets. Data from Geos-3, SEASAT, and Geosat are being compared to determine whether the ice-sheet surface elevations have changed during the approximately 10-year period of the measurements.